Key Outcomes
As of 10/26/2021, the statewide census was 542.

Source: https://public.tableau.com/profile/oregon.health.authority.covid.19#!/vizhome/OregonCOVID-19HospitalCapacitySummaryTables_15965754787060/HospitalizationbySeveritySummaryTable
Regional Hospital Census

Region 7 is showing smaller reductions in census than other regions in state.

Region 5 is showing moderate increase.

Other regions are trending downward.

Source: https://public.tableau.com/profile/oregon.health.authority.covid.19#!/vizhome/OregonCOVID-19HospitalCapacity/BedAvailabilitybyRegion
Hospital Census by US Region

All regions below 35 persons per 100k.

Trends are generally flat or declining, with a slight uptick in New England.

Source: https://carlsonschool.umn.edu/mili-misrc-covid19-tracking-project
Oregon, Washington, and California are following very similar paths of late and have been steadily declining, though the pace of decline is slowing.

Alaska is showing continued high levels and potentially a cold
Oregon Hospital Capacity

As of 10/26, 20% of occupied ICU beds are filled with COVID patients.

<table>
<thead>
<tr>
<th>Region</th>
<th>ICU</th>
<th>Non-ICU</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>17%</td>
<td>8%</td>
<td>9%</td>
</tr>
<tr>
<td>2</td>
<td>20%</td>
<td>12%</td>
<td>13%</td>
</tr>
<tr>
<td>3</td>
<td>19%</td>
<td>10%</td>
<td>11%</td>
</tr>
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<td>5</td>
<td>32%</td>
<td>12%</td>
<td>15%</td>
</tr>
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<td>6</td>
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<td>21%</td>
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<td>7</td>
<td>26%</td>
<td>21%</td>
<td>22%</td>
</tr>
<tr>
<td>9</td>
<td>28%</td>
<td>13%</td>
<td>16%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>20%</strong></td>
<td><strong>11%</strong></td>
<td><strong>12%</strong></td>
</tr>
</tbody>
</table>

Source: [https://public.tableau.com/profile/oregon.health.authority.covid.19#!/vizhome/OregonCOVID-19HospitalCapacitySummaryTables_15965754787060/HospitalizationbySeveritySummaryTable](https://public.tableau.com/profile/oregon.health.authority.covid.19#!/vizhome/OregonCOVID-19HospitalCapacitySummaryTables_15965754787060/HospitalizationbySeveritySummaryTable)
Oregon Hospital Capacity

The number of non-COVID patients continued to increase slightly.

These data are based on HOSCAP reports of individuals infected with COVID.

Source: https://public.tableau.com/profile/oregon.health.authority.covid.19#!/vizhome/OregonCOVID19HospitalCapacitySummaryTables_15965754787060/HospitalizationbySeveritySummaryTable
New Cases per Capita

Case rates continue to decline and have now dropped to previous fall/winter surge levels.

Oregon is 23rd highest in the US in the number of new cases per day.

Source: http://91-divoc.com/pages/covid-visualization/
Cases by Vaccination Status

Cases have declined for both vaccinated and unvaccinated individuals.

Admits by Vaccination Status

As of 10/21, breakthrough hospitalizations (4.4%) and deaths (1.0%) are showing declines along with cases and deaths.

The most recent complete week (10/17/21-10/23/2021) had a test positivity of 7.4%.

Total Tests

Testing remains at elevated levels. Positive and Negative COVID-19 test counts over time - All

Review of Leading Indicators
Behavior metrics remain at near pre-surge levels.

Note:

- Estimated percentage of respondents who went to an “indoor market, grocery store, or pharmacy” in the past 24 hours.
- Estimated percentage of respondents who went to an indoor “bar, restaurant, or cafe” in the past 24 hours.
- Estimated percentage of respondents who “spent time indoors with someone who isn’t currently staying with you” in the past 24 hours.
- Estimated percentage of respondents who “attended an indoor event with more than 10 people” in the past 24 hours.

Source: https://covidcast.cmu.edu/
Several metrics of activity continue to decrease in a pattern not too different from last year.

Without a long history of these metrics it is difficult to know what seasonality may exist.
As of week ending 10/26, the mask wearing rate is 82%.

Note:
Estimated percentage of people who wore a mask for most or all of the time while in public in the past 7 days; those not in public in the past 7 days are not counted.

Source: https://covidcast.cmu.edu/
Symptoms levels have tended to decline over last 8 weeks.

Note: “Symptoms” refer to community reports of COVID-like symptoms through Facebook surveys.

Source: https://covidcast.cmu.edu/
Statewide Forecast
Model Assumption-Waning Immunity

In order for the model to account for waning immunity of previous infection or vaccine, certain assumptions are needed. This model uses a basic structure which indicates:

1) Wane Starts: How many months after infection/vaccine waning begins.
2) Wane Duration: How long until waning is complete.
3) Wane Share: Percent of people who will not get boosters to prevent waning.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Standard (Vaccine)</th>
<th>Standard (Infection)</th>
<th>Short (Vaccine)</th>
<th>Short (Infection)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wane Start (months)</td>
<td>12</td>
<td>12</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Wane Duration (months)</td>
<td>24</td>
<td>24</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Wane Share</td>
<td>35%</td>
<td>50%</td>
<td>35%</td>
<td>50%</td>
</tr>
</tbody>
</table>

Model Assumption-Vaccine Volume

After brief bounce upward the number of first doses declined in last week.

“Fast” scenario shows a gradual decline in vaccination. It also assume 5-11 become eligible in November (earlier than previous forecast of December).

“Slow” scenario show previous pattern of declining vaccine providing little boost to immunity levels.

Model Assumption-Virus Spread Rate

With no new variants measured in Oregon, the transmission rate is driven by the estimated transmission rate of the Delta variant.

The “Fast” scenario assumes delta variant has an R0 of 8.0.

The “Slow” scenario assume R0=6.5

Source: Actuals from https://outbreak.info/location-reports?loc=USA_US-OR, Projections by Simulation by OHSU
Recent results are showing some decrease in effect. Four scenarios are constructed to show possible paths.

1) Fear and Fatigue: this is a full cycling through forecast period.
2) Fatigue without Fear: this shows what happens if no new fear cycle begins
3) Full Fatigue: This shows what happens if fatigue continues
4) No Fatigue: maintains recent effect level

Source: OHSU COVID Forecast Model
Census Forecast-Primary Scenario

The forecast shows a general decrease in census levels over 2-3 months.

The primary scenario is:

- “Fear w/o Fatigue” intervention effect
- Slow Variant (Delta $R_0=6.5$)
- High hospitalization rate for Delta (2X original)
- Vaccine efficacy=90%
- Waning immunity follows standard assumptions

Source: OHSU COVID Forecast Model
Census Forecast-Alternative Scenarios

The Scenarios for combinations of waning and policy/behavior assumptions are shown.

The primary specification is Fatigue w/o Fear with Standard Waning.
Previous Forecasts

The last 12 weeks of forecasts are shown.

Source: Primary scenario for each week is used
As of 10/26, the estimated population proportions are:
Susceptible: 23%
Vaccinated: 42%
Infected: 24%
Vaccinated & Infected: 11%

Source: OHSU COVID Forecast Model
Local Forecasts
Regional Forecasts

Source: OHSU COVID Forecast Model, OHA
Regional Herd Charts

Source: OHSU COVID Forecast Model, OHA
Policy Issues
Oregon has given a first dose to 68.1% of population (not just eligible).

This rate ranks 20th in the US.

Source: https://covid.cdc.gov/covid-data-tracker/#vaccinations
Pediatric Census in Oregon

The pediatric census level in Oregon for confirmed positive patients under age 18 is 7 as of 10/27.

Source: https://healthdata.gov/Hospital/COVID-19-Reported-Patient-Impact-and-Hospital-Capa/g62h-syeh/data
Pediatric Census in Other States

The pediatric hospitalized census is mostly flat in the last week across key states.

Source: https://healthdata.gov/Hospital/COVID-19-Reported-Patient-Impact-and-Hospital-Capa/g62h-syeh/data
The masking wearing rate amongst unvaccinated increased to 58% in last week. The rate amongst vaccinated remained steady at 90%.

Source: https://delphi.cmu.edu/covidcast/surveys/
Indoor restaurant and bar visits increased slightly for the vaccinated to 30%, nearly equivalent to the rate for unvaccinated.

Source: https://delphi.cmu.edu/covidcast/surveys/
Vaccinated and Unvaccinated had small increases in large indoor events (15% and 25%, respectively).

Source: https://delphi.cmu.edu/covidcast/surveys/
Time with Others by Vaccination Status

Time with others indoors is back to pre-surge levels for both the vaccinated and unvaccinated.

Source: [https://delphi.cmu.edu/covidcast/surveys/](https://delphi.cmu.edu/covidcast/surveys/)
Death Forecast

The recent week of data by date of death showed an increase. This is expected to decrease and follow the hospitalization pattern.

Assumptions to project deaths from infections/hospitalizations:
1) Deaths lag infections by an average of 21 days.
2) There are 5.0 COVID hospitalizations per death from COVID.

Source: OHSU COVID Forecast Model, OHA
Influenza in Oregon

In Oregon, there have been small numbers of positive influenza tests but the second chart shows that is typical for the beginning of the flu season.

Source:
Influenza Trends

Across the globe the amount of influenza has been low when measured against previous seasons where as many as 30k infections per week were detected.

Appendix
The most recent forecast was issued on 10/20.

This model shows impact of potential of continuation of recent transmission level versus the rate from a week prior that had a lower level of transmission.

*Figure 5: Observed hospitalized cases for Oregon and projection scenario. Black dots show observed daily counts, while the grey line shows model fit. The colored lines show hospitalizations projected assuming the estimated transmission rate of October 6 (red) or the average transmission rate of September 30 – October 6 (green). Shaded areas: 2.5th-97.5th percentile ranges.*
CDC forecasts shows a slowing in the decline in new hospital admissions.
As of 10/1, IHME shows the hospital census increasing slightly through the forecast period.

Projections and scenarios

We produce three scenarios when projecting COVID-19. The reference scenario is our forecast of what we think is most likely to happen:

- Vaccines are distributed at the expected pace. Brand- and variant-specific vaccine efficacy is updated using the latest available information from peer-reviewed publications and other reports.
- Future mask use is the mean of mask use over the last 7 days.
- Mobility increases as vaccine coverage increases.
- Governments adapt their response by re-imposing social distancing mandates for 6 weeks whenever daily deaths reach 8 per million, unless a location has already spent at least 7 of the last 14 days with daily deaths above this rate, and not yet re-imposed social distancing mandates. In this case, the reference scenario assumes that mandates are re-imposed when daily deaths reach 15 per million.
- Variants Alpha, Beta, Gamma, and Delta continue to spread regionally and globally from locations with sufficient transmission.

The worse scenario modifies the reference scenario assumption in four ways:

- 100% of vaccinated individuals stop using masks.
- Mobility increases in all locations to 25% above the pre-pandemic winter baseline, irrespective of vaccine coverage.
- Governments are more reluctant to re-impose social distancing mandates, waiting until the daily death rate reaches 15 per million, unless a location has already spent at least 7 of the last 14 days with daily deaths above this rate, and not yet re-imposed social distancing mandates. In this case, the reference scenario assumes that mandates are re-imposed when daily deaths reach 38 per million. In either case, we assume social distancing mandates remain in effect for 6 weeks.
- Variants Alpha, Beta, Gamma, and Delta spread between locations twice as fast when compared with our reference scenario.

The universal masks scenario makes all the same assumptions as the reference scenario but assumes all locations reach 95% mask use within 7 days.
Effective R Estimates

This chart shows the effective R estimated weekly using hospitalization data in the model.

Model: The OHSU state hospital census forecast is an SIR model that includes traditional assumptions about first transmission (2/1/2020), doubling rate (5 days), days from exposure to admissions (12 days), length of stay (7 days, 13 days for ICU), and recovery period (14 days). It has an innovative feature which is that it includes a factor that moderates transmission rates which is called policy effectiveness. The factor is estimated historically for key policy dates and/or weekly intervals. It also allows future policies to be projected.

Source: OHSU COVID Forecast Model
Acknowledgements

Each week this model requires updates, input and expertise from many people.

I would like to thank Dr. William Messer for his assistance in understanding waning dynamics, Brian O’Roak and Xuan Qin, at OHSU, for their expertise to understand genetic sequencing information, and the hospital forecasting workgroup for their feedback on weekly forecasts, including collaboration with Julie Maher and Erik Everson at Multnomah County PDES.

I would also like to give a special thank you to Michael Johnson from St. Charles Health who helped develop an early version of the model that has proven to be a good structure to handle the many twists and turns the problem has required.

Thank you!